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ACIDIC PRECIPITATION IN ONTARIO STUDY (APIOS) TERRESTRIAL EFFECTS NORTHWESTERN ONTARIO

Preliminary Report, 1983

Lichen Monitoring Program
Southwest Thunder Bay District
Samples collected 1970-71 and 1983

P. Barclay
Centre for Regional Development
Lakehead University

Ministry of the Environment
Ontario

Lakehead University Thunder Bay

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Preliminary Report
Lichen Monitoring Program
Southwest Thunder Bay District
Samples collected 1970-71 and 1983

P. Barclay
Manager-Supervisor, Terrestrial Effects
Centre for Regional Development
Lakehead University

Acidic Precipitation in Ontario Study
Terrestrial Effects
Northwestern Region
Ontario Ministry of the Environment

September, 1984

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Introduction

In 1970-71, in southwest Thunder Bay District, various sets of samples were taken to provide baseline data on the status of vegetation and soil at that time. In 1981, twenty-six of the original ninety-eight sample sites were re-sampled for soil, bark, and lichens. A preliminary report was prepared (Barclay, 1981) describing the original study, its purposes, its criteria for site selection, and the methods used for soil and bark samples. This 1981 report also gave detailed descriptions of the locations and sites sampled in that year, and should be referred to for this information.

Although 20 sites were sampled for lichens in 1981, the main emphasis was on bark and soil sampled. Therefore, in order that a more comprehensive assessment be made of the lichens as accumulators of various substances, such as sulphate and heavy metals, the present study was planned.

Sample Site Selection, Site Locations and Site Descriptions

The original site selection was based on a number of criteria outlined in the 1981 report. Site selection for 1983 sampling was based primarily on the availability of sufficient 1970-71 sample material for chemical analysis, and secondly on whether the original sample site could be relocated. If there was a 1970-71 sample of at least 1.0 g, that site was a candidate for 1983 sampling. If the site could be re-located, then resampling was carried out.

Thirty-one of the 1970-71 sites had one or more lichen samples of at least 1.0 g. Three of these sites could not be located and therefore 28 sites were visited and sampled. A number of the sites had more than one lichen species which had been previously sampled. Therefore, in 1983, forty-five lichen samples were collected. Table 1 lists latitude, longitude, elevation, and dates of collection for each site. Table 2 gives site locations and site descriptions, and is to be used together with a set of 1:50,000 Canadian Government topographic maps supplied with this report.

TABLE 1. Sites sampled in 1983, latitude, longitude, altitude (metres ± 15), dates of sample collection.

SITE NO.	LATITUDE	LONGITUDE	ALTITUDE (m)	DATE OF COLLECTION 1970-71	1983
F-5-C	48° 28'	89° 57'	425	12May71	2Sept.
G-8-E	48° 10'	89° 48'	400	26Aug70	27Aug.
H-3-C	48° 42'	89° 38'	440	13May71	26May.
H-4	48° 38'	89° 43'	440	10Jul70	31Aug.
H-5-C	48° 28'	89° 37'	380	4Jun70	19Jul.
H-6	48° 25'	89° 47'	400	1Jun70	30Aug.
H-7-C	48° 14'	89° 37'	410	2Jun70	28Aug.
H-9-E	48° 03'	89° 34'	380	21Aug70	16Jul.
I-3-C	48° 40'	89° 29'	425	25Jun70	19Jul.
I-6	48° 25'	89° 32'	305	13May70	30Aug.
I-7	48° 18'	89° 31'	305	19May70	24Jul.
I-7-C	48° 14'	89° 27'	290	28May70	16,24Jul.
I-8	48° 11'	89° 34'	335	27May70	24Jul.
J-3	48° 45'	89° 24'	440	25Jun70	11Jul.
J-5	48° 32'	89° 21'	410	13May70	30Aug.
J-5-C	48° 26'	89° 18'	290	11Aug70	26May
J-6-C	48° 20'	89° 17'	275	2Jul70	6Sept.
J-8-S	48° 06'	89° 21'	215	13Aug70	3Sept.
K-4	48° 37'	89° 11'	410	8Jul70	31Aug.
K-4-C	48° 34'	89° 06'	440	12Jun70	31May.
K-5	48° 32'	89° 11'	380	12Jun70	31May.
K-5-C	48° 30'	89° 02'	190	6May71	3Sept.
M-3-C	48° 41'	88° 43'	425	15May71	26Aug.
M-4-C	48° 34'	88° 45'	215	22Jun70	26Aug.
M-6-C	48° 20'	88° 46'	200	25Aug70	14Jul.,26Aug.
N-3-C	48° 42'	88° 35'	230	15May71	26Aug.
N-5	48° 31'	88° 38'	200	19Jun70	14Jul.,26Aug.
N-6	48° 25'	88° 45'	245	18Jun70	14Jul.

TABLE 2. Collection site locations and descriptions.

F-5-C	Kakabeka Falls 1:50,000 map. Sackville Township haul road. The site is 30 m south of the road and 0.8 km west of the Serpent Creek bridge. An open rock outcrop, facing north and moderately sloped. There is good bryophyte and lichen cover on the rock area which is surrounded by second growth mixed forest.
G-8-E	Pigeon River 1:50,000 map. Fraleigh Township. The site is 25 m north of the road to Fallingsnow Lake, at the base of the hill 2.1 km from the lake. Mature mixed forest on a level well drained site. Both the shrub layer and the herb layer are well developed.
H-3-C	Sunshine 1:50,000 map, Fowler Township. The site is 3.0 km from the control gate (Dog Lake Picnic Area) on the road to the Dog Lake Dam. The *Cladina* area is 10 m west of the road and the *Parmelia* area is 30 m west of the road. The rock area is an open outcrop with good lichen and moss cover and surrounded by mixed forest trees. The forest is mixed in a generally flat area with wet depression and drier higher rocky rises. There is a well developed shrub layer and often good moss cover as well.
H-4	Sunshine 1:50,000 map Forbes Township. The site is the old homestead road (now a logging road) 9.5 km north of the Finmark CPR crossing. The *Parmelia* collection made mostly west of the road but some to the east as well. Cutover mixed forest in a relatively flat area. There is a good shrub layer and a good herb layer.
H-5-C	Kakabeka Falls 1:50,000 map Conmee Township. 40 m south of Brulé Creek Road (east of Highway 11-17), at the bridge crossing Brulé Creek. A mixed conifer-deciduous forest, partly cutover, on a rather dry north facing hillside. There are good shrub and herb layers and also good bryophyte and lichen areas.
H-6	Kakabeka Falls 1:50,000 map Conmee Township 0.32 km west of 3rd crossroad on Blind Line Road west of Highway 11-17. Site is 40 m north of the road. A mixed swampy forest area mostly cedar, tamarack and speckled alder. Birch for *Parmelia* collection is scarce.

TABLE 2 (Cont'd.)

H-7-C	Kakabeka Falls 1:50,000 map Scoble Township. On the top of the cliffs at the west end of Oliver Lake north of the public access area. Flat open flat rock area about 20 m north of the cliff top surrounded by a mixed jack pine and aspen forest.
H-9-E	Pigeon River 1:50,000 map, Pardee Township. East facing cliffs 150 m east of Lenore Lake. Small open rock areas partly surrounded by shrubs and a mixed forest, open to the east.
1-3-C	Onion Lake 1:50,000 map Fowler Township. 160 m on Hwy. 591 west of the Hawkeye Lake Biogeochemical Study Site access road. The site is at the top of the ridge 60 m south of the road. This is a mixed forest with sparce to moderate shrub and herb layers.
1-6	Kakabeka Falls 1:50,000 map Oliver Township. The site is 1 km north of Hwy 130 and 25 m west of Corbett Creek Road (just north of the bridge). The site is a swampy mixed forest area. There are well developed shrub and herb layers.
1-7	Kakabeka Falls 1:50,000 map Paipoonge Township. The site is 35 m south of the road on the south end of Candy Mountain and is 0.1 km east of the Paipoonge-Scoble boundary. This is a mixed forest with moderately developed shrub and herb layers.
1-7-C	There are two collection areas, one for *Parmelia* and the other for *Cladina* and *Umbilicaria*. The *Parmelia* area is on the Jarvis River 1:50,000 map in Blake Township. The site is 2.4 km on Blake Hall Road from Hwy 61 and it is 30 m south of the road. This is a mixed forest with well developed shrub and herb layers. *Cladina* - *Umbilicaria* area is on the Pigeon River 1:50,000 map in Scoble Township. The site is 2.7 km from Hwy 61 and is 50 m east of Hwy 608. The site is an open rock area near the top of the west facing cliff. Jack pine and aspen are around the open areas.

TABLE 2 (Cont'd.)

I-8	Pigeon River 1:50,000 map in Pearson Township. The site is on a rock ridge 100 m east of Hwy 597. The collection site is an open area at the top of ridge. Shrubs and some small aspen are around the site.
J-3	East Bay 1:50,000 map. The site is 0.25 km south of the resort at the end of the road. The site is 15 m west of the road. This is a mixed forest in a low area near the lake. There are good shrub and herb layers but bryophytes and lichens are mostly sparse.
J-5	Onion Lake 1:50,000 map. Gorham Township. The site is on a side road 1.0 km west of Hwy 589. The sideroad is 3.6 km south of Lappe. The site is 50 m south of the sideroad. This is a swampy mixed forest. The shrub layer is moderate as is the herb and ground layers.
J-5-C	Thunder Bay 1:50,000 map, McIntyre Ward. This site is 10 m south of the north facing cliff north of the Ministry of Transport enclosure on Rabbit Mountain. This is an open flat rock area. A lichen-moss-dwarf shrub heath.
J-6-C	Thunder Bay 1:50,000 map, Fort William Indian Reserve. The site is 150 m northwest of the ski house at the top of the main Mt. McKay Chair Lift. This is a large talus slope at the base of a northwest facing cliff. Some birch and aspen are at the edge of the slope.
J-8-S	Jarvis River 1:50,000 map. Crook Township. The site is about 100 m southeast of the road, near the top edge of a steep northeast facing cliff. This is a rocky shallow soil area with a mixed forest surrounding the open rock collecting areas.
K-4	Onion Lake 1:50,000 map. Gorham Township. The site is on the west side of the Onion Lake Dam up the hill about 100 m. This is a mixed forest on a moderately steep south facing slope. There is good *P. sulcata* cover on the white birch trees.
K-4-C	Onion Lake 1:50,000 map. Shuniah Township. There are two collection areas - one for P. sulcata and one for *U. muhlenbergii* and *C. mitis*. The *Parmelia* area is 100 m. southeast of Hwy. 527, 16 km north of Hwy 11-17. This is a mixed forest on a northwest facing hillside.

TABLE 2. (Cont'd.)

	The *Umbilicaria* and *Cladina* area is at the same location, but is about 200 m from Hwy. 527 on the west shore of a small lake. There are open rock outcrops partly surrounded by mixed forest.
K-5	Onion Lake 1:50,000 map. Gorham Township. There are two sites (close together), one for *Parmelia* and one for *Cladina*. Both sites are on Wild Rose Road (off the Copenhagen Road). The *Parmelia* site is 50 m south of Wild Rose Road and 50 meters west of Copenhagen Road. The *Cladina* site is 15 m north of Wild Road Road and 100 m from Copenhagen Road. Both sites are mixed forest but the *Cladina* site has open rock areas in the forested area.
K-5-C	Onion Lake 1:50,000 map. Shuniah Township. The site is 50 m south of Lakeshore Drive and 0.4 km east of the Wild Goose Hotel. This is a swampy mixed forest with considerable speckled alder and willow present.
M-3-C	Loon 1:50,000 map. Shuniah Township. This site is 50 m east of the road to the amythest mine on Elbow Lake. The site is at the north end of a small lake 0.3 km south of the gate to the mine area. This is a swampy mixed forest with open rock outcrops near the lake.
M-4-C	Loon 1:50,000 map. Shuniah Township. There are two close-together collecting sites. The *Parmelia* site is 15 m west of Hwy. 587 and just north of the Bak Road. This is a mixed forest area. The *Umbilicaria* and *Cladina* site is east at the top of the cliff east of the picnic area, east of Hwy. 587, and east of the railway. There are open rock areas surrounded by a mixed forest on shallow soil.
M-6-C	Thunder Cape 1:50,000 map. Sibley Township. There are two collecting sites about 3 km apart. The *Parmelia* site is 15 m north of the tote road to Middlebrun Bay. The site is 150 m west of the bay. This is a mixed forest site on sandy well-drained soil. The *Umbilicaria* and *Cladina* site is on the top of the rock bluffs about Hwy. 587 and west of the south end of Grassy Lake. Mixed forest surrounds the open rock area. Both *Umbilicaria* and *Cladina* are sparse at this site.

TABLE 2 (Cont'd.)

N-3-C	Loon 1:50,000 map. Shuniah Township. This site is at the base of cliffs 100 m west of the south end of Ancliff Lake (2 km south of Hwy. 11-17). This site is on large rocks at the base of an east facing cliff. The area is bordered by a mostly hardwood forest.
N-5	Loon 1:50,000 map. Sibley Township. There are two collecting sites about 2 km apart. The *Parmelia* site is 50 m east of Squaw Bay Road at the cottage access road to Moonlight Beach on Louse Cove. This is a mixed forest. The *Cladina* site is 2 km south of the *Parmelia* site 15 m west of the road. There are rock outcrops in a mixed forest.
N-6	Thunder Cape 1:50,000 map. Sibley Township. This site is 150 m west of Hwy. 587 and 4.4 km south of the turnoff to Lizard Lake. This is a rich mixed forest in a flat area over the top of the hill.

Methods

Vegetation (lichen) Methods

A. Field Methods: During the 1970/71 study, 75 sites were sampled for lichens to be used in chemical analyses. In 1981, twenty of these sites were re-sampled for lichen material and in 1983 an additional 29 sites were re-sampled. If sufficient material was available, Parmelia sulcata was collected from white birch trees. The trees were located in the general area of the ground quadrat and the epiphyte sample trees, and several were sampled. When available, Parmelia was collected by hand or sometimes using a Swedish Mora hunting knife. Evernia mesomorpha was collected by hand as well from balsam fir at some sites. If suitable open rock areas were in the proximity, samples of Umbilicaria spp. and Cladina mitis s.l. were collected as well from several spots. These species were always collected by hand. All material was placed in a polythene bag, returned to the laboratory, and stored in a deep freeze.

B. Laboratory Methods were as follows:

1. The lichen samples were removed from the deep freeze, hand cleaned to remove as much bark, conifer needles, etc. as possible and then air dried on aluminum baking trays for 2 to 10 days.
2. They were then ground in a blender and sieved with a #60 mesh sieve. The sieved material was

returned to a polythene bag, labelled, placed in boxes and stored in a laboratory in closed cupboards.

3. Some chemical analyses were done for Pb, Cd, Hg, Cl, and SO_4. These analyses were done by Bondar-Clegg using methods outlined on the following photocopies.

BRANCH OFFICES
1500 PEMBERTON AVE., [illegible]
NORTH VANCOUVER, B.C. [illegible]

BONDAR-CLEGG & COMPANY LTD.

764 BELFAST ROAD (M.R. 1), OTTAWA 8, ONTARIO
PHONE: 237-3110 TELEX: 013-3548

January 14, 1972.

Dr. P. Barclay,
Assistant Professor,
Lakehead University,
Postal Station P,
Thunder Bay, Ontario.

Dear Dr. Barclay:

We have finally finished the last 75 sulphate analyses in your Group 3, Vegetation and Bark, samples. Our Certificate of Analysis is enclosed.

Further to your request, we are pleased to give you a short outline of the analytical methods used for the Cd, Pb, Hg, Cl, and SO_4 analyses:

General: All samples were rolled on a sheet of paper prior to weighing for Cd, Pb and Hg determination. For Cl and SO_4 analysis the sample was mixed well in the original sample container.

All glassware was cleaned thoroughly with dilute acids, followed by thorough distilled water rinsings. Liberal use was made of Blanks and standards carried through the respective procedures.

Outline of Methods:

1) Determination of Lead and Cadmium:
Method is attached.

2) Chlorine and Sulphate:

2.0g. of sample were fused in a Platinum crucible with 5g of CP sodium carbonate. The melt was dissolved in distilled water and, finally, brought to near boiling. Heavy metals, which were precipitated as carbonates, were filtered off. The filtrate was made up to 100 ml, was halved and acidified with HNO_3 (for Cl) or HCl (for SO_4). Chlorine was precipitated as AgCl and SO_4 as Ba SO_4.

.../2

Turbidity of AgCl was measured on an Unicam SP 500 Spectrophotometer at 500 mu against standards which were carried through the entire procedure.

The Sulphate analysis was finished gravimetrically, i.e. final weighing of $BaSO_4$.

3) Mercury (Cold Vapour Method):

0.5g of sample was digested with conc. nitric and hydrochloric acids on a water bath. In the diluted sample, mercury was reduced with stannous sulphate. The free mercury was vaporised and its absorption measured using the Perkin-Elmer MAS 50 Mercury Analyser.

If you need any more information, please do not hesitate to contact us.

Sincerely yours,

BONDAR-CLEGG & COMPANY LTD.

U. Dienstbach

U. Dienstbach
Chief Chemist
Analytical Laboratory

Encl.

UD/cj

BONDAR-CLEGG & COMPANY LIMITED

- OTTAWA ANALYTICAL LABORATORY -

Determination of Cadmium and Lead in Soils and Vegetation Samples.

(Lakehead University Project)

PLEASE NOTE: All glassware to be cleaned with dilute nitric and hydrochloric acids and rinsed with distilled water.

Transfer entire sample on a sheet of paper, roll and weigh 0.5g of material into a pre-cleaned 250 ml Griffin beaker. Add 15 ml of acid mix (800 ml of HNO_3 and 400 ml of $HClO_4$), immerse sample completely, cover and place on a warm hotplate for half and hour. Agitate occasionally. Then, increase heat and bring to first perchloric acid fumes. Take off, cool, add 2 ml HNO_3 and 1 ml HCl place on hotplate and fume to just dryness. Cool.

Redissolve with 2.5 ml of HCl and add 15 ml of water, cover and heat to redissolve. Transfer into 25 ml volumetric flask and"police" beaker, cool, make up to mark and mix. Transfer into plastic storage vial.

Determine Lead and Cadmium concentration by AA technique, using standard settings, against a reagent blank and standards carried through the entire procedure i.e. Blank, and Blanks plus 2.5, 50, 10.0, 15.0, 20, 25.0, 50.0, 75.0 and 125.0 ug of Cd and Pb per 25 ml (i.e. 0.1, 0.2, 0.4, 0.6, etc ppm Pb and Cd)

Report in ppm Pb and ppm Cd.

Run every tenth sample in duplicate and dope with an appropriate amount of Pb and Cd to [illegible] on recovery and/or matrix interference.

Results

No analyses have been received to date for the twenty-eight 1970-71 lichen samples, or for the twenty-three 1981 lichen samples which were sent to the Ontario Ministry of the Environment for analysis. The present whereabouts of these samples is not known and it is possible that they may be lost. However, a few analyses of these samples, mostly of sulphate were done by Bondar-Clegg, and these are given in Table 3. The Bondar-Clegg results show some samples to have substantial amounts of sulphate. However, no trend is evident and without more information, no hypotheses can be made. All lichen samples (1970-71, 1981, and 1983) are to be analyzed for 22 elements as follows: Al, As, B, Ca, Cd, Cl, Cr, Cu, F, Fe, Hg, K, Mg, Mn, Mo, N, Na, Ni, P, Pb, S, Zn. All analyses of the 1983 collections and for the seventeen 1970-71 collections sent in 1983 have been completed.

Table 4 shows a list of samples collected by site and by lichen species. Maps 1, 2, 3, and 4 show locations of sample sites by species. There is a map for *Parmelia sulcata*, one for *Evernia mesomorpha*, one for *Cladina mitis* and one for *Umbilicaria* spp (*U. vellea* and *U. muhlenbergii*). These maps include all collections referred to in this report and in the 1981 report (except 1970 lichen samples that had less than one gram of weight). The lists of 1970-71 and 1981 samples included on the maps are given in Table 5 and Table 6.

TABLE 3

LICHEN ANALYSES - 1970 - 1971 SAMPLES

SITE	SPECIES	Pb ppm	Cd ppm	Hg ppb	Cl ppm	SO_4 ppm
F-1-C	*Parmelia sulcata*					370
F-4-C	*Parmelia sulcata*					520
G-1-C	*Parmelia sulcata*					60
G-8	*Parmelia sulcata*					580
	Umbilicaria muhlenbergii					630
I-9-S	*Parmelia sulcata*					3300
J-4	*Parmelia sulcata*	57	1.0	350	645	3050
J-6	*Parmelia sulcata*	115	1.2	340	665	5500
	Evernia mesomorpha	70	0.6	650	230	230
K-3-C	*Parmelia sulcata*					710
M-4	*Parmelia sulcata*					290
N-2-C	*Parmelia sulcata*					580
N-3	*Parmelia sulcata*					250
N-6	*Parmelia sulcata*	69	1.5	285	67	361

TABLE 4. 1983 Lichen collections.

SITE NO.	SPECIES	COLLECTION DATE (1983)	WEIGHT (grams)
F-5-C	*Cladina mitis*	2 Sept.	21.0
G-8-E	*Parmelia sulcata*	27 Aug.	5.1, 12.1*
H-3-C	*C. mitis*	26 May	10.2
H-3-C	*P. sulcata*	26 May	3.0, 2.5
H-4	*P. sulcata*	31 Aug.	16.0
H-5-C	*Evernia mesomorpha*	19 July	6.6, 11.3
H-5-C	*P. sulcata*	19 July	6.3, 9.4
H-6	*P. sulcata*	30 Aug.	7.5, 9.7
H-7-C	*C. mitis*	28 Aug.	14.4
H-9-E	*C. mitis*	16 July	4.8, 16.6
H-9-E	*Umbilicaria muhlenbergii*	16 July	6.4, 12.1
I-3-C	*P. sulcata*	19 July	4.4, 5.4
I-6	*E. mesomorpha*	30 Aug.	10.4, 11.5
I-6	*P. sulcata*	30 Aug.	3.5, 4.1
I-7	*E. mesomorpha*	24 July	4.5, 6.1
I-7	*P. sulcata*	24 July	2.9, 9.9
I-7-C	*C. mitis*	24 July	11.7
I-7-C	*P. sulcata*	16 July	4.2, 10.4
I-7-C	*U. vellea*	24 July	19.7
I-8	*C. mitis*	24 July	13.1
J-3	*P. sulcata*	11 July	2.0, 5.7
J-5	*E. mesomorpha*	30 Aug.	8.4, 13.6
J-5-C	*C. mitis*	26 May	10.1, 17.5
J-6-C	*U. muhlenbergii*	6 Sept.	36.5
J-8-S	*C. mitis*	3 Sept.	17.7
J-8-S	*U. muhlenbergii*	3 Sept.	17.1
K-4	*P. sulcata*	31 Aug.	18.0
K-4-C	*C. mitis*	31 May	13.2

TABLE 4. (Cont'd.)

SITE NO.	SPECIES	COLLECTION DATE (1983)	WEIGHT (grams)
K-4-C	*P. sulcata*	31 May	3.8, 10.3
K-4-C	*U. muhlenbergii*	31 May	4.4, 8.7
K-5	*C. mitis*	31 May	14.0
K-5	*P. sulcata*	31 May	2.8, 7.1
K-5-C	*P. sulcata*	3 Sept.	10.4
M-3-C	*C. mitis*	26 Aug.	18.9
M-3-C	*P. sulcata*	26 Aug.	4.0, 7.6
M-4-C	*C. mitis*	26 Aug.	18.7
M-4-C	*P. sulcata*	26 Aug.	8.0, 9.3
M-4-C	*U. vellea*	26 Aug.	30.3
M-6-C	*C. mitis*	26 Aug.	12.0
M-6-C	*P. sulcata*	14 July	5.0, 4.2
M-6-C	*U. vellea*	26 Aug.	5.5, 12.1
N-3-C	*U. vellea*	26 Aug.	10.2, 38.4
N-5	*C. mitis*	26 Aug.	10.7, 33.6
N-5	*P. sulcata*	14 July	4.1, 8.1
N-6	*P. sulcata*	14 July	5.0, 7.8

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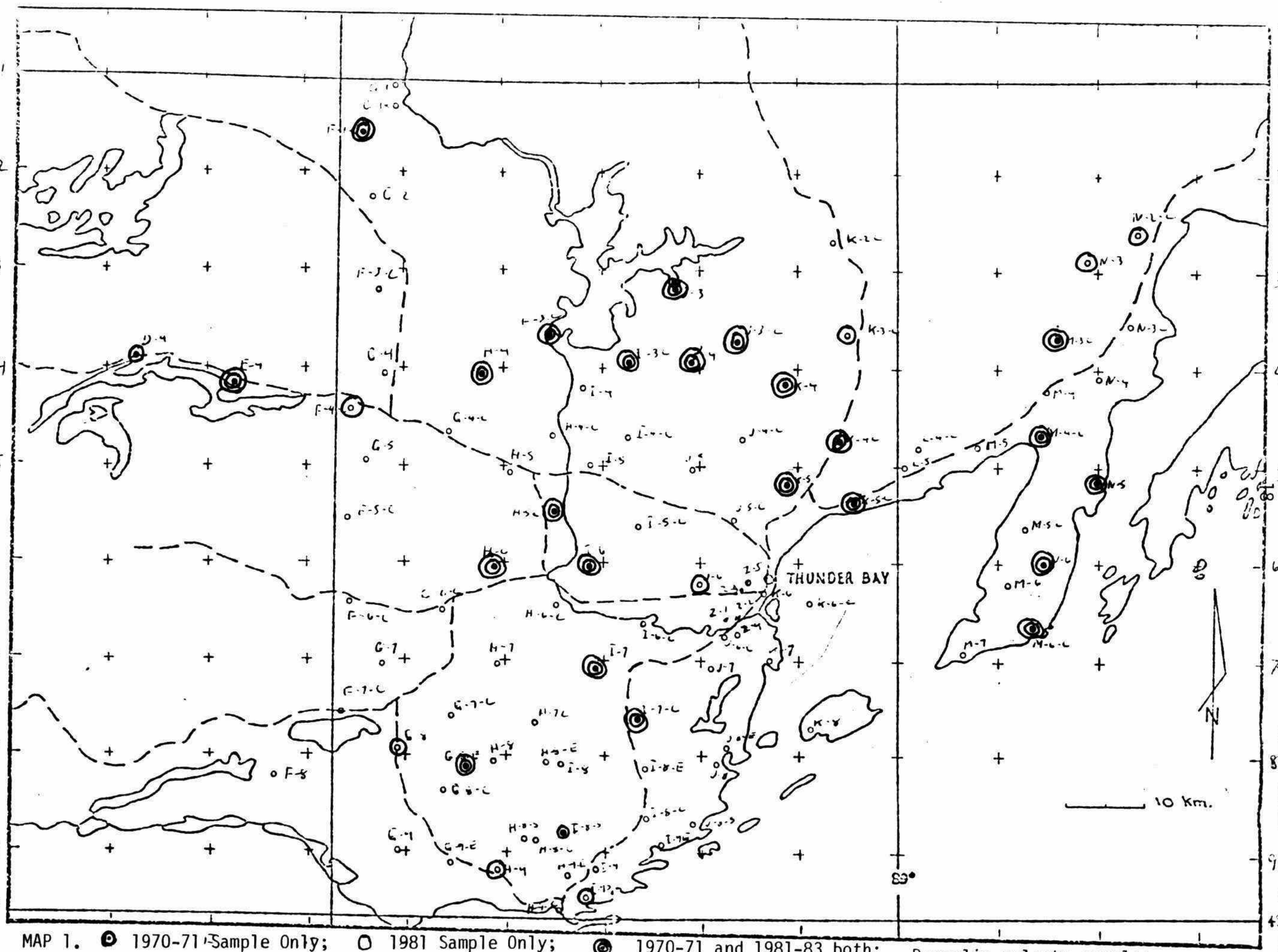
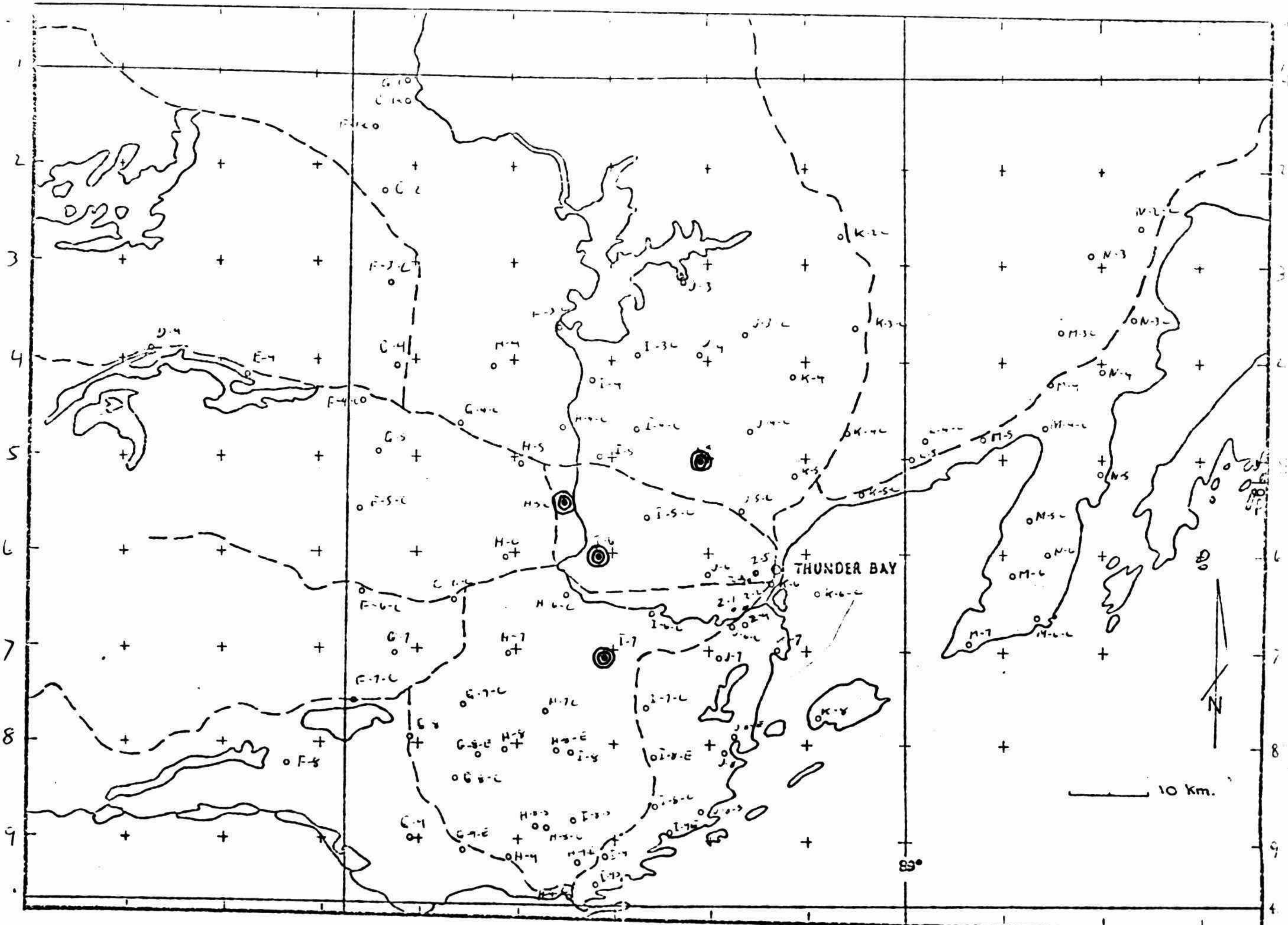
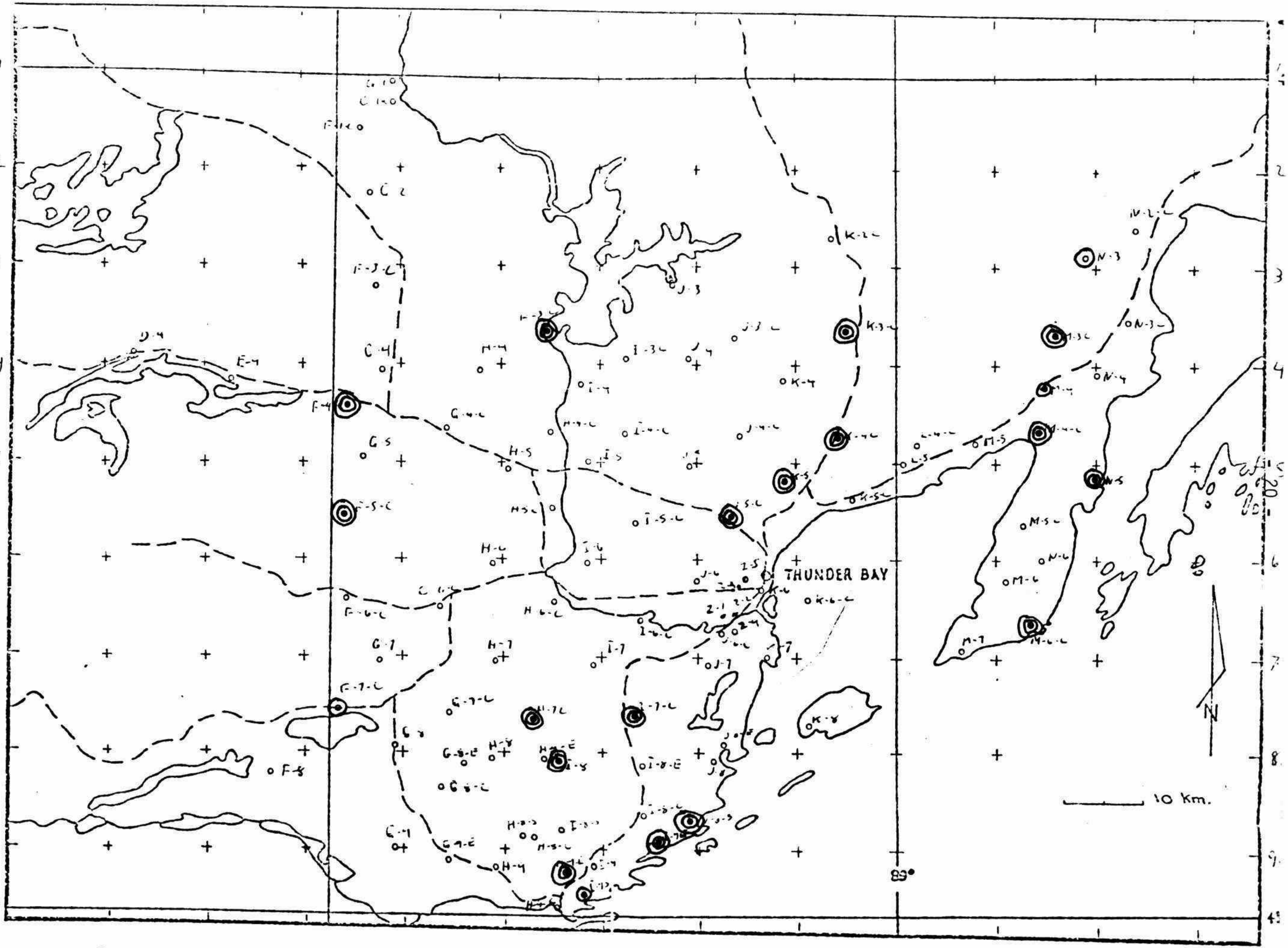
*The first value is the weight of the completely ground and seived sample. The second value is the weight of the remaining unseived sample and is included in a separate container (Container 2).



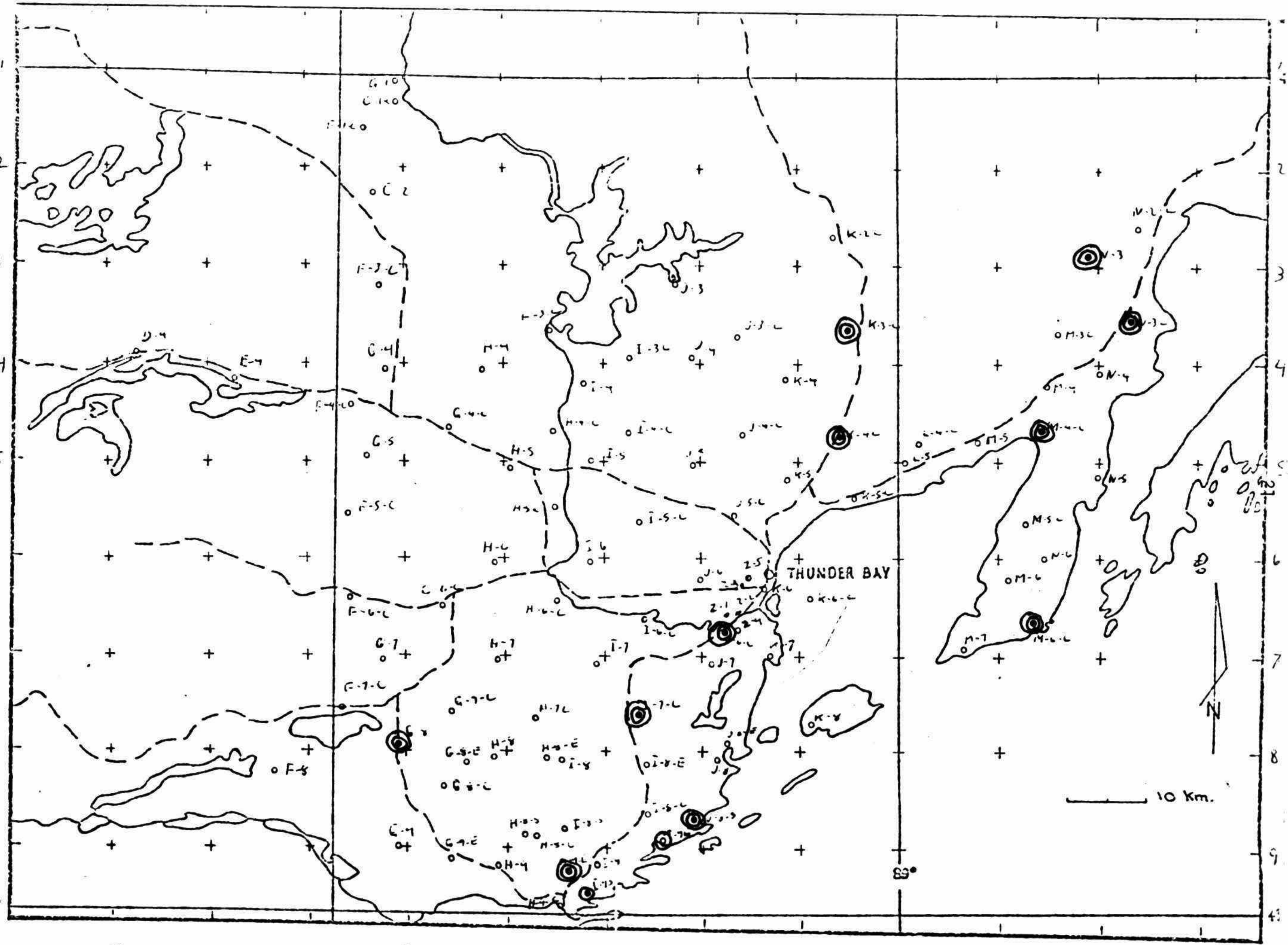
MAP 1. ● 1970-71 Sample Only; ○ 1981 Sample Only; ◎ 1970-71 and 1981-83 both; *Parmelia sulcata* samples.



MAP 2. ◎ Both 1970 and 1980 Evernia mesomorpha samples.



MAP 3. ⊙ 1970 only; ○ 1980 only; ◎ both 1970 and 1980;   Cladina mitis samples.



MAP 4. ⊙ 1970 only; ○ 1980 only; ◎ both 1970 and 1980; Umbilicaria vellea and some U. muhlenbergii samples.

TABLE 5

1970 - 1971 LICHEN SAMPLES

SITE NO.	DATE	LONGITUDE	LATITUDE	SPECIES	WEIGHT(g)
D-4	27Aug70	48° 39'	90° 21'	*Parmelia sulcata*	2.0
E-4	27Aug70	48° 38'	90° 11'	*Parmelia sulcata*	3.5
F-1-C	1July70	48° 55'	89° 57'	*Parmelia sulcata*	2.5
F-4-C	28May70	48° 36'	89° 58'	*Cladina mitis* s.l.	7.5
F-7-C	27May71	48° 14'	89° 58'	*Cladina mitis* s.l.	5.5
G-8	15Jun70	48° 11'	89° 53'	*Umbilicaria vellea*	4.5
I-8-S	26Aug70	48° 06'	89° 33'	*Parmelia sulcata*	2.0
I-9-E	13Aug70	48° 05'	89° 24'	*Cladina mitis* s.l.	7.5
I-9-S	21Aug70	48° 01'	89° 31'	*Cladina mitis* s.l.	4.0
I-9-S	21Aug70	48° 01'	89° 31'	*Umbilicaria vellea*	40.0
J-3-C	13May71	48° 40'	89° 15'	*Parmelia sulcata*	4.5
J-4	24Jun71	48° 40'	89° 21'	*Parmelia sulcata*	2.5
K-3-C	17Jun70	48° 42'	89° 05'	*Umbilicaria vellea*	5.5
K-3-C	17Jun70	48° 42'	89° 05'	*Cladina mitis* s.l.	6.5
M-4	6May71	48° 37'	88° 45'	*Cladina mitis* s.l.	4.5
N-3	23Jun70	48° 47'	88° 35'	*Umbilicaria muhlenbergii*	4.5
N-6	18Jun70	48° 25'	88° 45'	*Parmelia sulcata*	1.0

TABLE 6

1981 LICHEN SAMPLES

SITE NO.	DATE	LONGITUDE	LATITUDE	SPECIES	WEIGHT(g)
E-4	3Jul81	48° 38'	90° 11'	*Parmelia sulcata*	3.5
F-1-C	14Jul81	48° 55'	89° 57'	*Parmelia sulcata*	16.0
F-4-C	3Jul81	48° 36'	89° 58'	*Parmelia sulcata*	11.0
F-4-C	3Jul81	48° 36'	89° 58'	*Cladina mitis* s.l.	46.0
F-7-C	8Jul81	48° 14'	89° 58'	*Cladina mitis* s.l.	42.75
G-8	8Jul81	48° 11'	89° 53'	*Umbilicaria vellea*	47.5
G-8	8Jul81	48° 11'	89° 53'	*Parmelia sulcata*	8.5
H-9	6May81	48° 03'	89° 42'	*Parmelia sulcata*	1.0
I-9-E	29Jun81	48° 05'	89° 24'	*Cladina mitis* s.l.	38.5
I-9-E	29Jun81	48° 05'	89° 24'	*Umbilicaria vellea*	58.0
I-9-S	29Jun81	48° 01'	89° 31'	*Parmelia sulcata*	4.0
J-3-C	15Jul81	48° 40'	89° 15'	*Parmelia sulcata*	9.0
J-4	15Jul81	48° 40'	89° 21'	*Parmelia sulcata*	6.5
J-6	12May81	48° 25'	89° 21'	*Evernia mesomorpha*	3.0
J-6	12May81	48° 25'	89° 21'	*Parmelia sulcata*	5.75
K-3-C	19May81	48° 42'	89° 05'	*Cladina mitis* s.l.	34.0
K-3-C	19May81	48° 42'	89° 05'	*Umbilicaria muhlenbergii*	24.0
K-3-C	19May81	48° 42'	89° 05'	*Umbilicaria vellea*	6.5
K-3-C	19May81	48° 42'	89° 05'	*Parmelia sulcata*	4.75
N-2-C	25Jun81	48° 49'	88° 34'	*Parmelia sulcata*	4.0
N-3	25Jun81	48° 47'	88° 35'	*Parmelia sulcata*	4.75
N-3	25Jun81	48° 47'	88° 35'	*Cladina mitis* s.l.	24.5
N-3	25Jun81	48° 47'	88° 35'	*Umbilicaria muhlenbergii*	13.0

Conclusions

The objective of this study is to compare two sets of samples of lichen material which were collected in southwestern Thunder Bay District more than ten years apart. These lichen samples, some of which are epiphytes and some ground lichens, are well distributed through this area. They will show not only spacial trends but also if there has been any significant alteration in the accumulation of various substances such as heavy metals and sulphate. A final report is planned for completion in 1985.

Reference

Barclay, P. 1981. Technical Report Concerning Soil and Vegetation samples collected during 1970-71 and 1981. Ontario Ministry of the Environment, Thunder Bay.

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Preliminary report, lichen
monitoring program, southwest
Thunder Bay district : samples
collected 1970-1971 and 1983 /
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